



GDC

The Sunset Overdrive Navigation Mesh Data Pipeline

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AI ARTIFICIAL INTELLIGENCE
SUMMIT

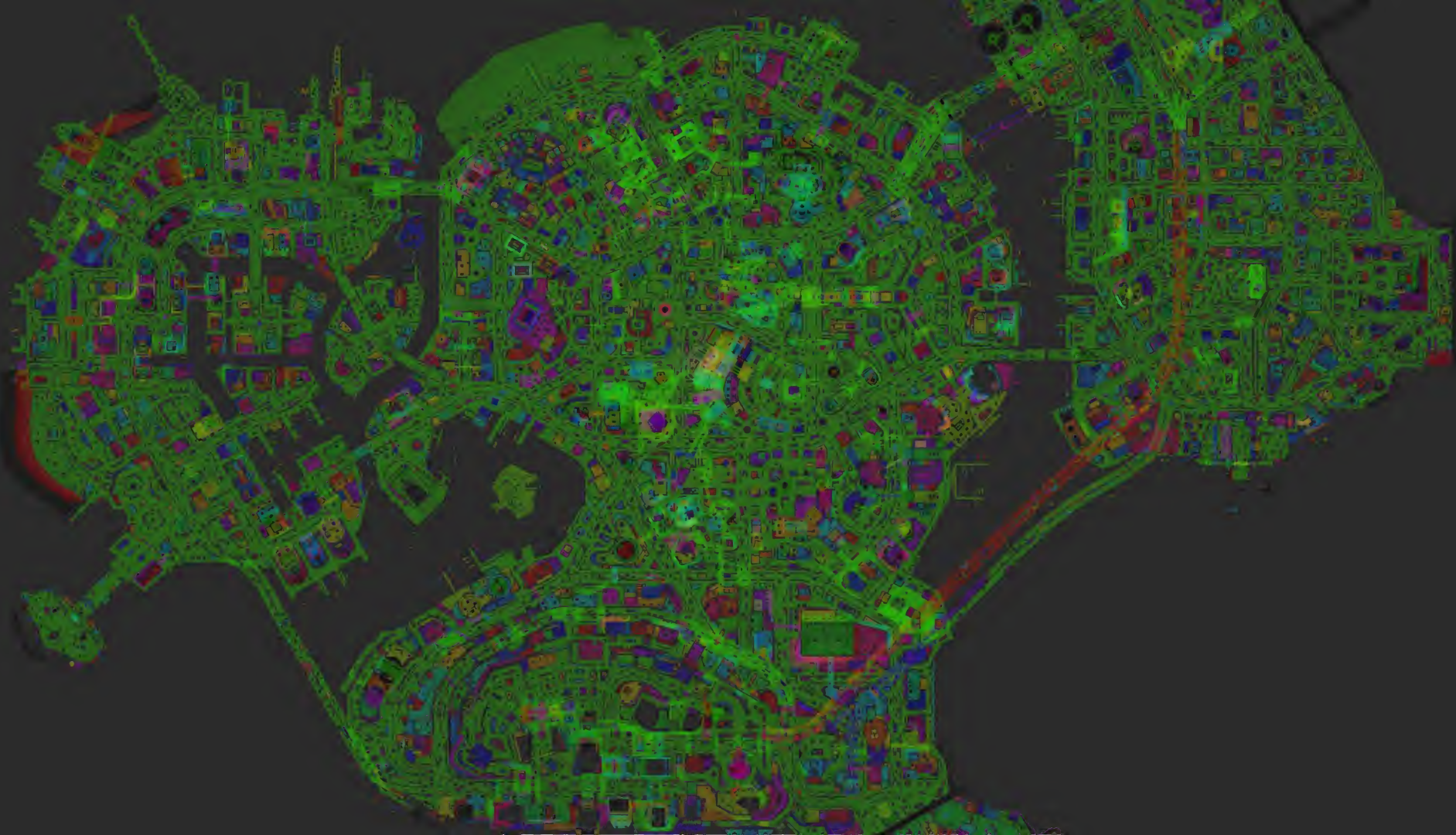
GAME DEVELOPERS CONFERENCE
MOSCONE CENTER - SAN FRANCISCO, CA
MARCH 2-5, 2015 - EXPO - MARCH 4-5, 2015











An aerial, high-angle view of a dense urban environment, likely a city grid. The image is dark and slightly blurred, with various buildings and streets visible. Overlaid on this background is white text. The text is arranged in four lines, each starting with a line of text. The first line is the largest and most prominent. The second and third lines are smaller. The fourth line is the largest again, matching the first line in size. The text is all in a bold, sans-serif font.

Sunset City.

700,000 model instances, spread over 12km²

127,000 pieces of nav-influencing markup

All told, 300,000,000 triangles to process.



Increased user efficiency & data quality...



Increased user efficiency & data quality...
through Improved User Experience!



User Experience



User Experience

Before:

Part of level-editor

Error-prone setup process

Unreliable

Dark Magic





User Experience

Before:

Part of level-editor

Error-prone setup process

Unreliable

Dark Magic

After:





User Experience

Before:

Part of level-editor

Error-prone setup process

Unreliable

Dark Magic

After:

Standalone application

One-click

Reliable*

Universally accessible





Increased user efficiency & data quality...



Increased user efficiency & data quality...
through Decreased Running Time!





Running time: Loading the input data



Running time: Loading the input data

Before:





Running time: Loading the input data

Before:

Source data (JSON)

Everything





Running time: Loading the input data

Before:

Source data (JSON)

Everything

10-15 minutes





Running time: Loading the input data

Before:

Source data (JSON)

Everything

10-15 minutes

After:



Running time: Loading the input data

Before:

Source data (JSON)

Everything

10-15 minutes

After:

Binary game data

Geo, instance data & markup





Running time: Loading the input data

Before:

Source data (JSON)

Everything

10-15 minutes

After:

Binary game data

Geo, instance data & markup

5 seconds





Running time: Building the navmesh



Running time: Building the navmesh

Before:

For each tile:

Setup

Generate navmesh



Running time: Building the navmesh

Before:

For each tile:

Setup

Generate navmesh



Running time: Building the navmesh

Before:

For each tile:

Setup

Generate navmesh

50 minutes





Running time: Building the navmesh

Before:

For each tile:

Setup

Generate navmesh

50 minutes





Running time: Building the navmesh

Before:

After:

For each tile:

Setup

Generate navmesh

50 minutes





Running time: Building the navmesh

Before:

For each tile:

Setup

Generate navmesh

50 minutes

After:

Setup

For each tile (parallel):

Generate navmesh





Running time: Building the navmesh

Before:

For each tile:

Setup

Generate navmesh

50 minutes

After:

Setup

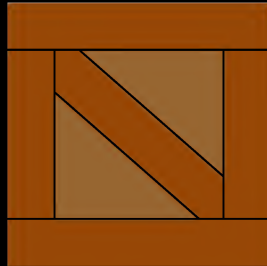
For each tile (parallel):

Generate navmesh

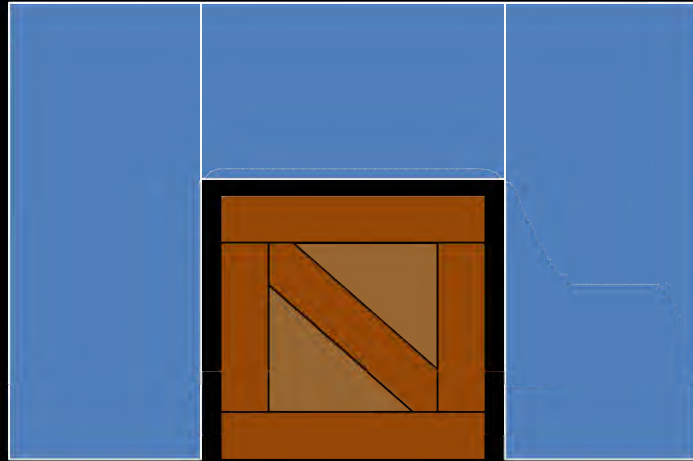
44 seconds



Running time: Spatial queries



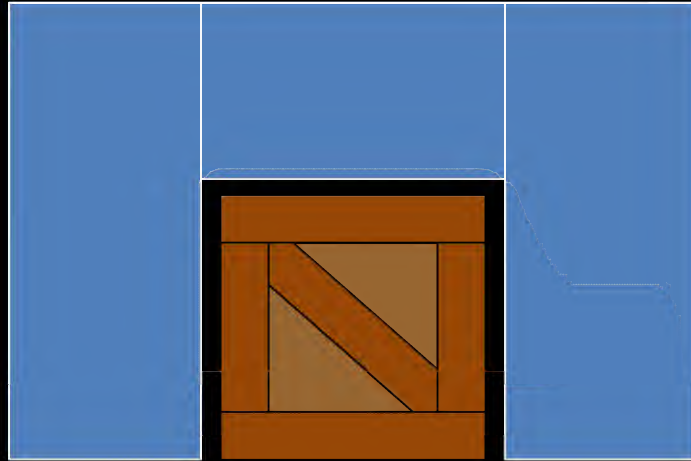
Running time: Spatial queries



Running time: Spatial queries

Before:

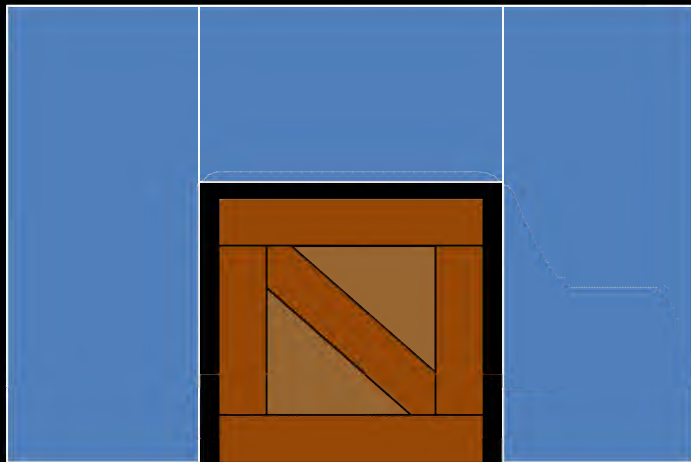
30 minutes



Running time: Spatial queries

Before:

30 minutes

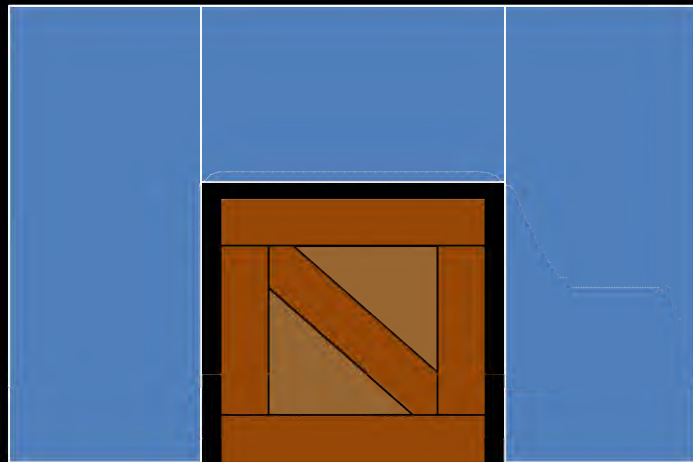


After:

Running time: Spatial queries

Before:

30 minutes

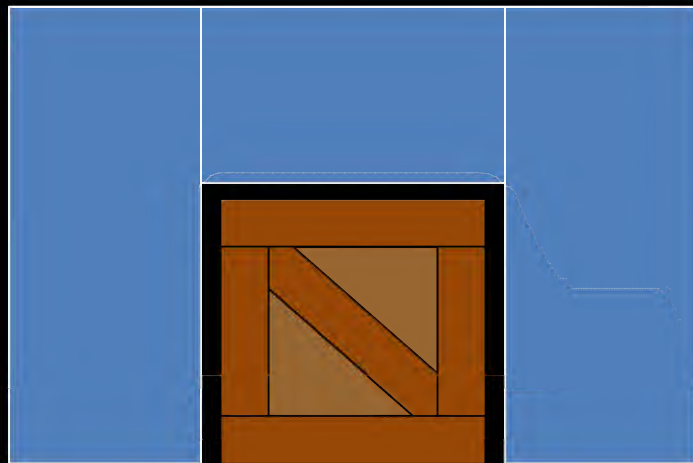


After:

***Use recast's
voxels***

Running

30 minutes



Use recast's

voxels

0 seconds





Running Time Summary





Running Time Summary

Before: 10 + 50 + 30 minutes






Running Time Summary

Before: 10 + 50 + 30 minutes

After: 5 + 44 + 0 seconds





Running Time Summary

Before: 10 + 50 + 30 minutes

After: 5 + 44 + 0 seconds

Assessment:





Running Time Summary

Before: 10 + 50 + 30 minutes

After: 5 + 44 + 0 seconds

Assessment: Adequate.





Increased user efficiency & data quality...



Increased user efficiency & data quality...
through Post Processing!

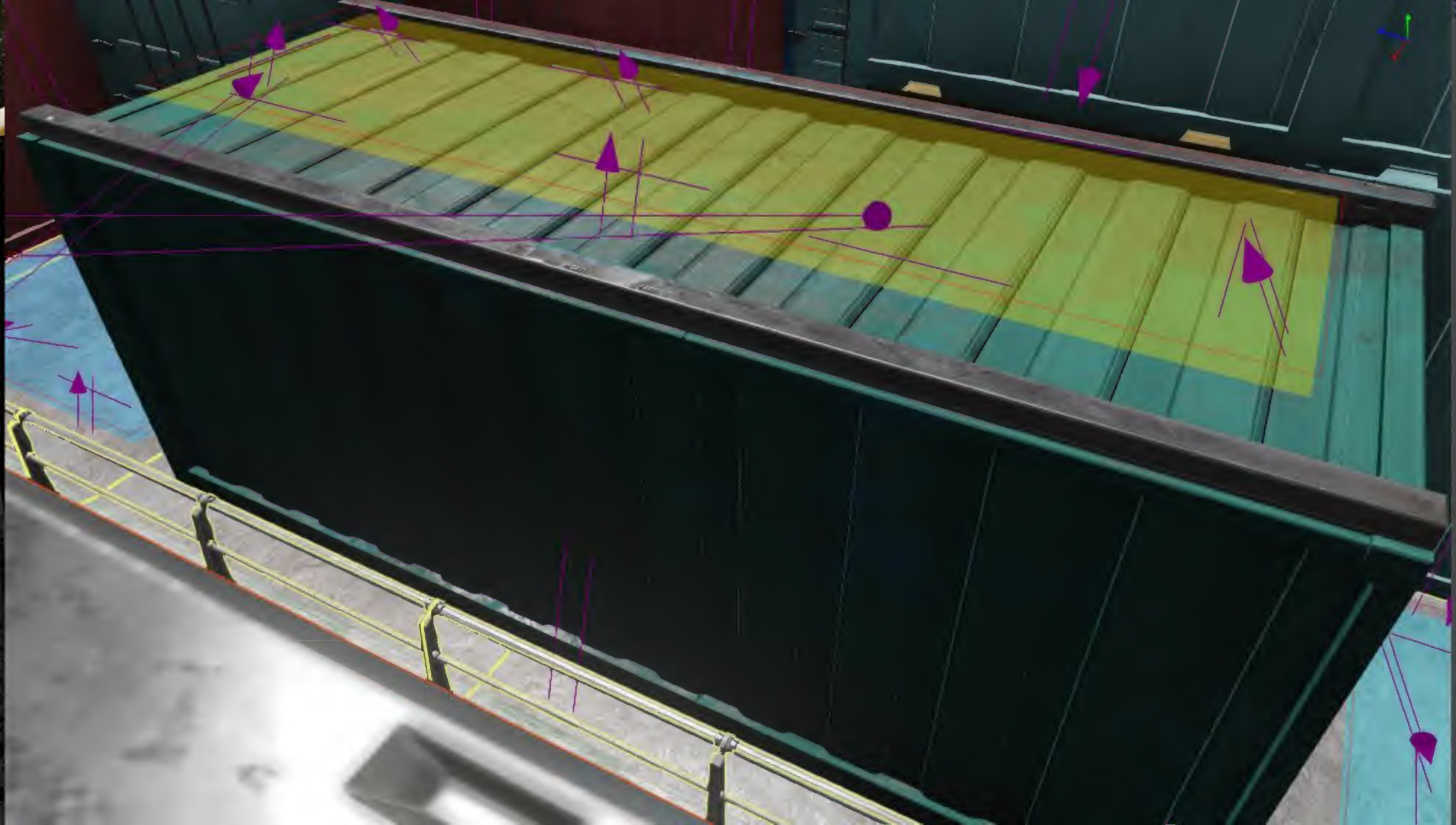


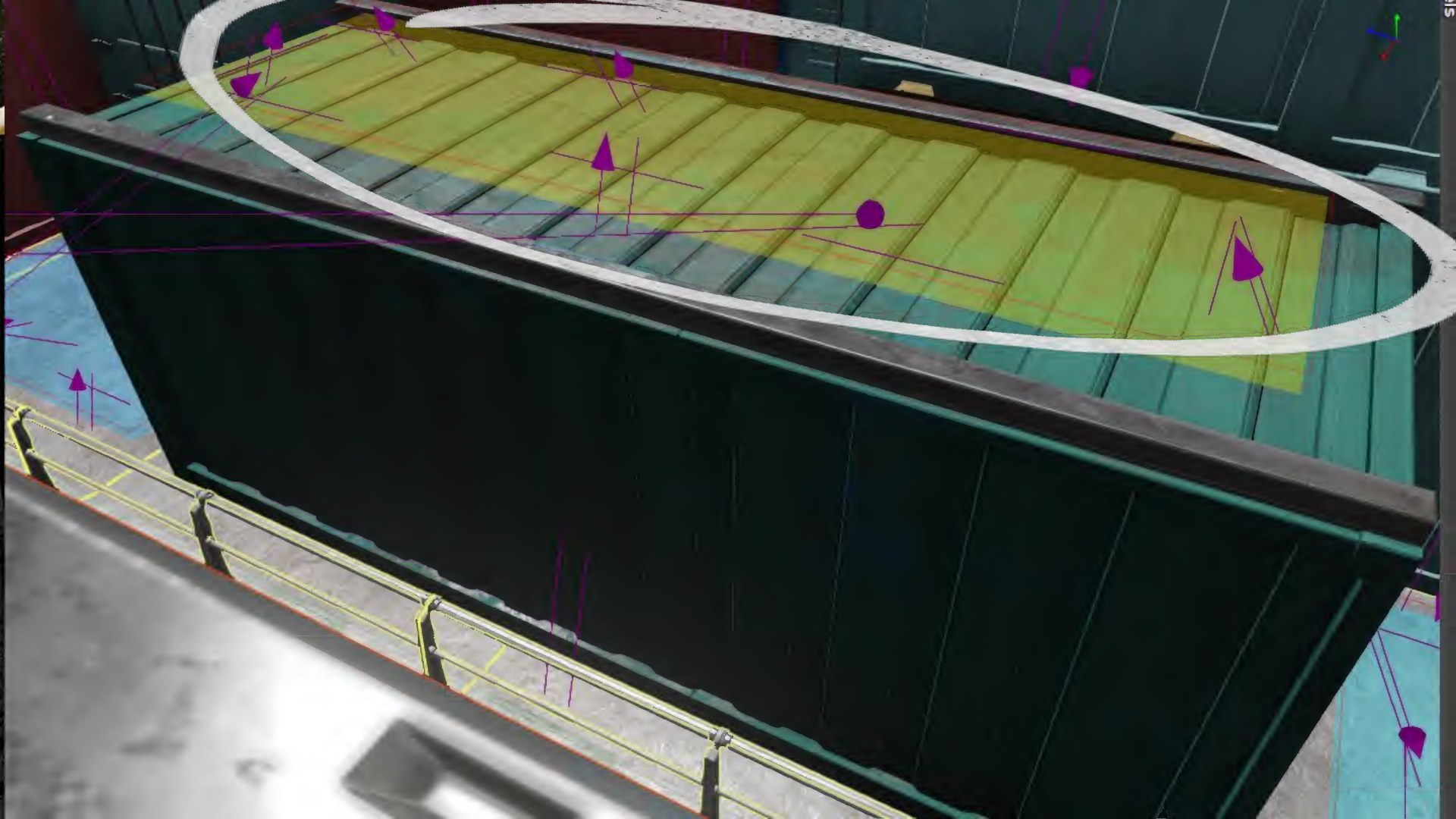


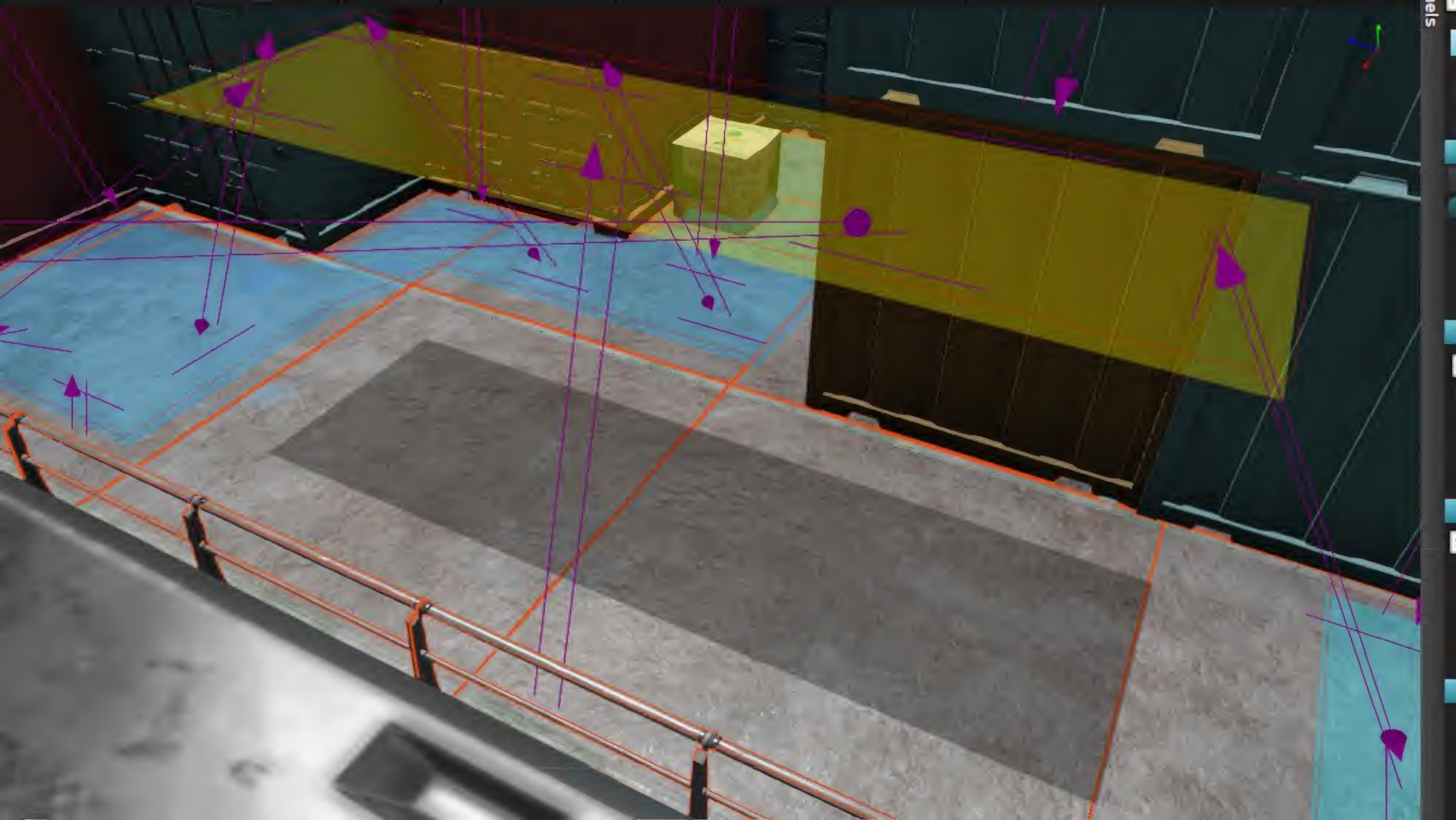
Postprocessing

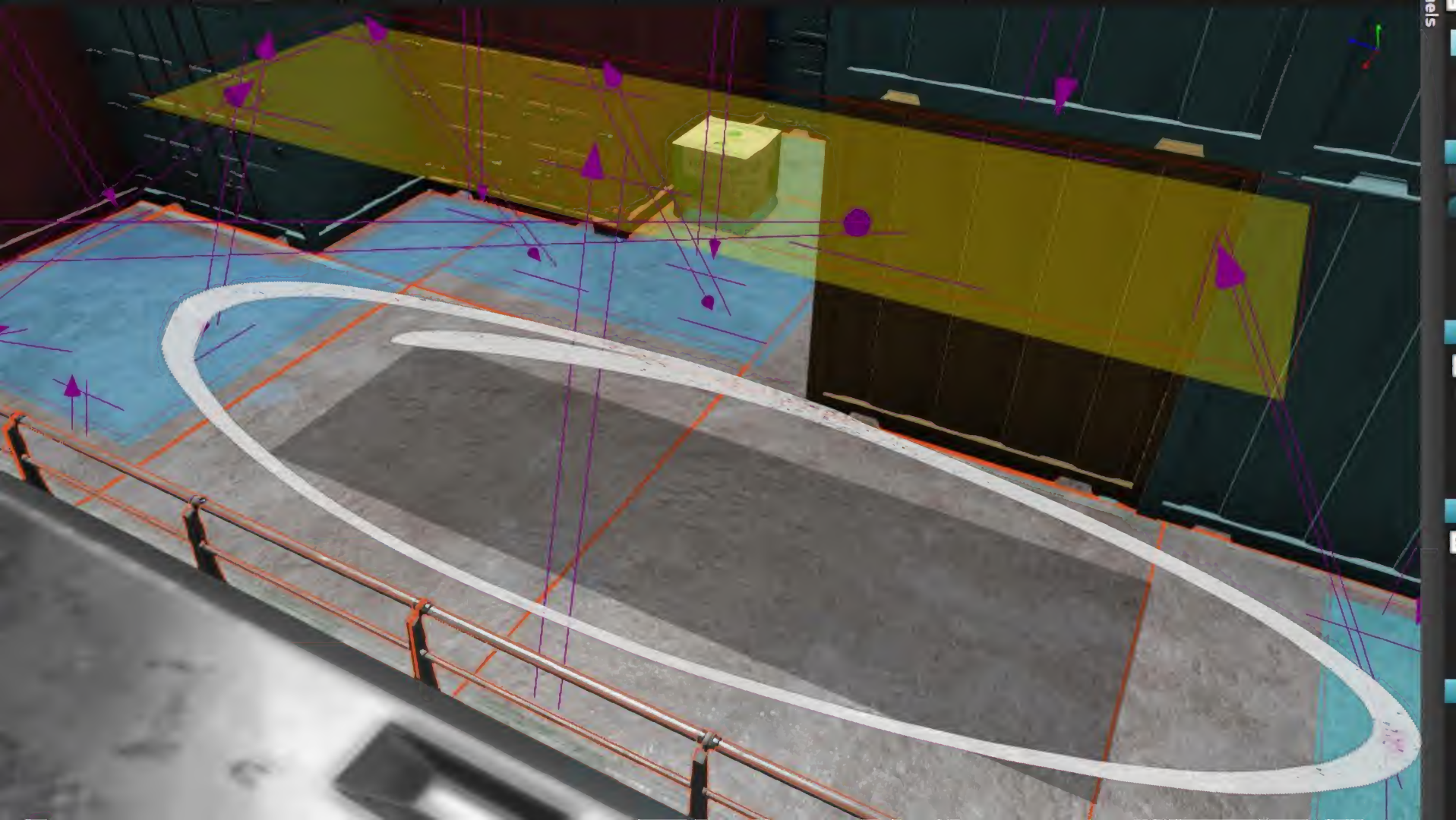
Detect and discard unreachable mesh islands













Postprocessing

Build data for use in editor and in game

Minimize subsequent transformations





Increased user efficiency & data quality.

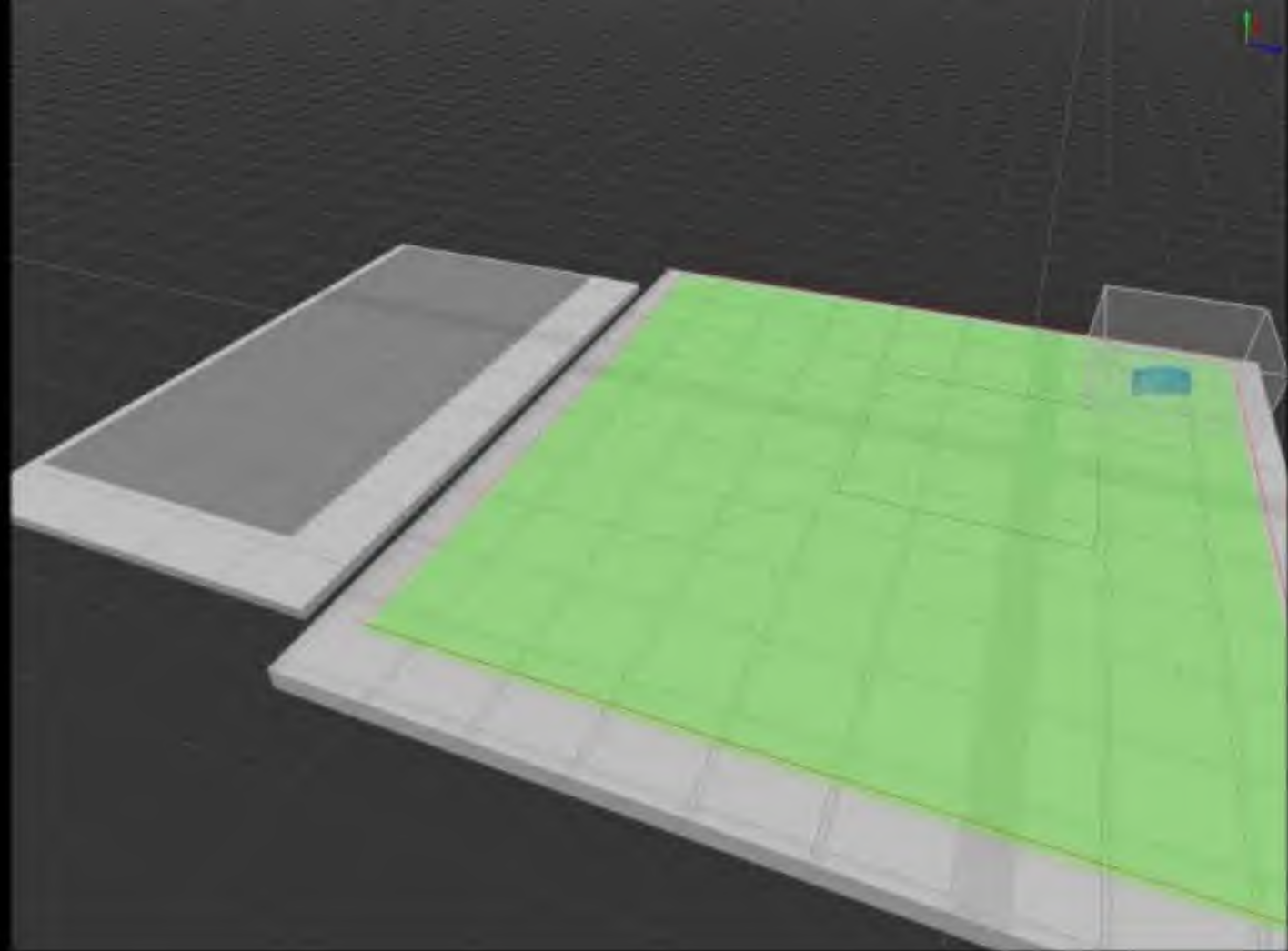


Navigation tools



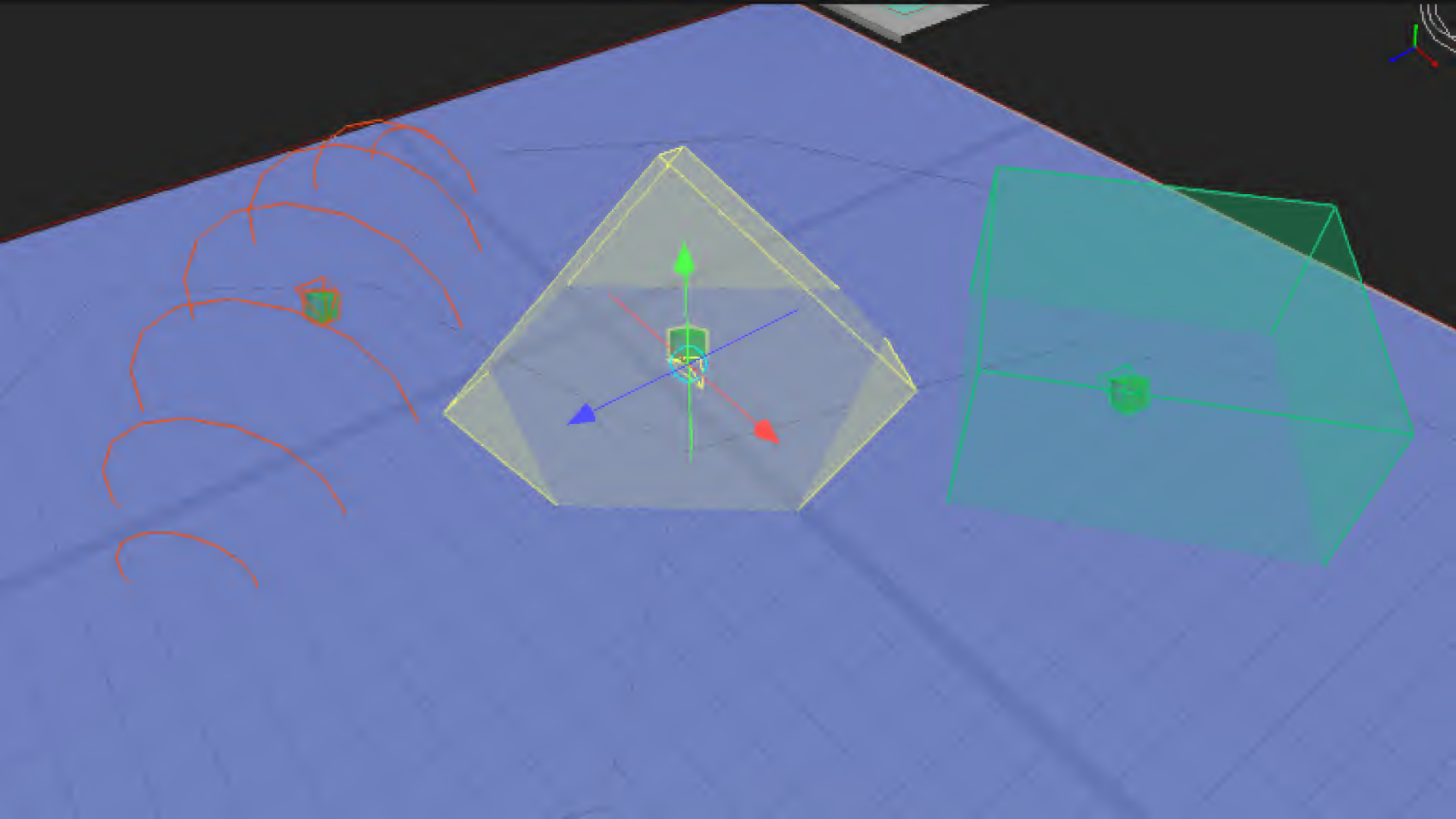
Navigation tools: Overrides

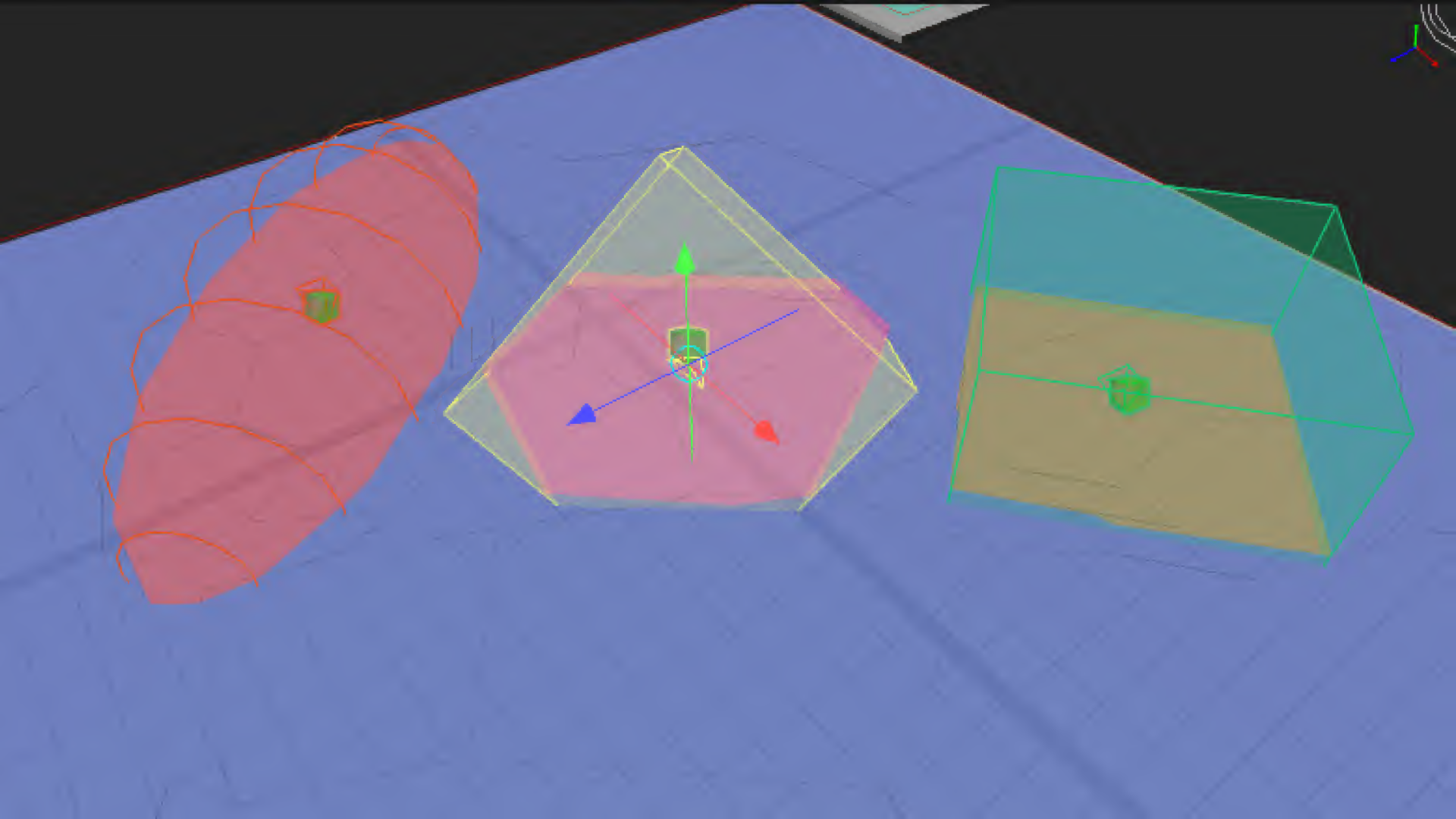
(Additive and subtractive)

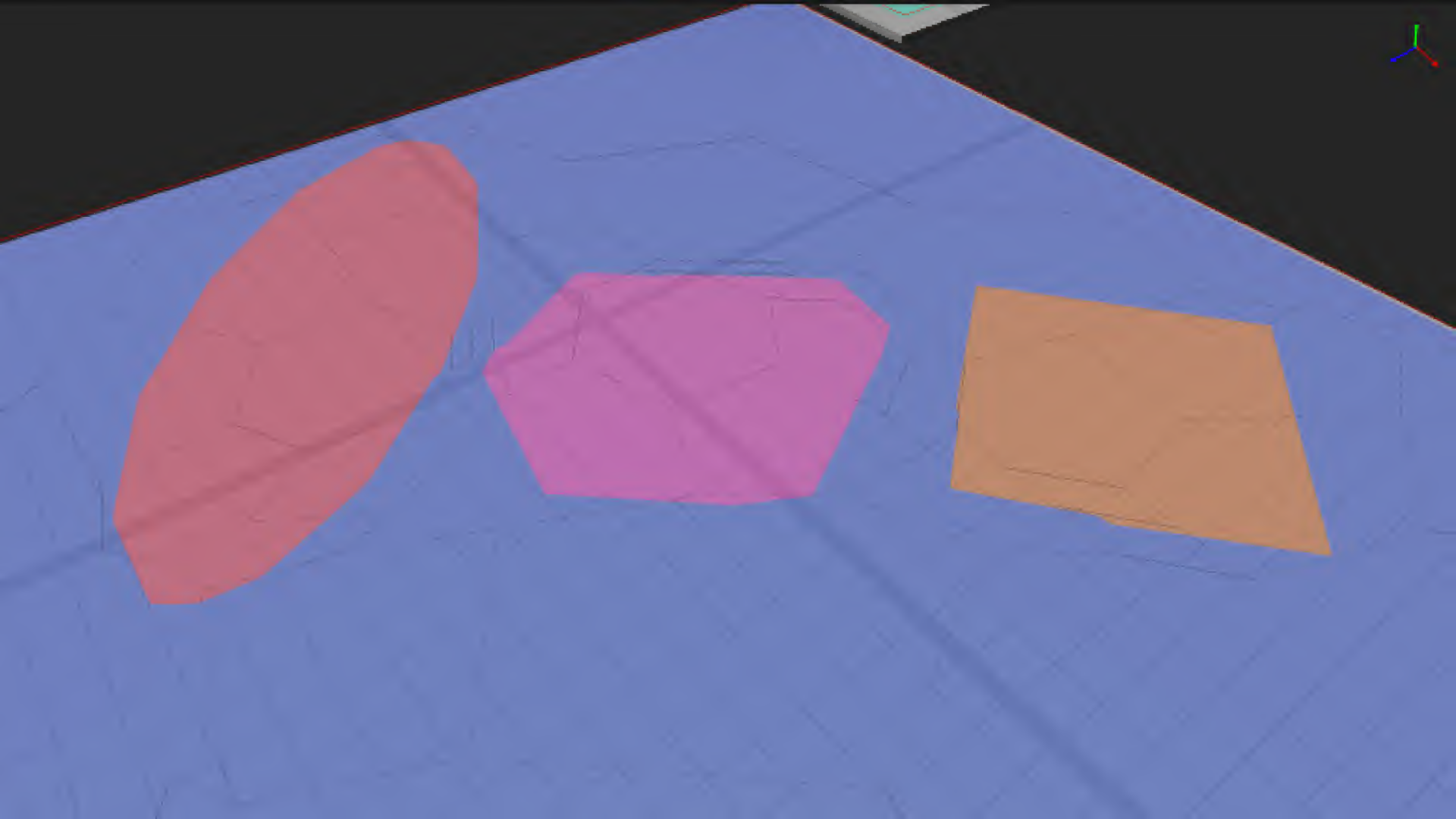




Navigation tools: Poly Flagging









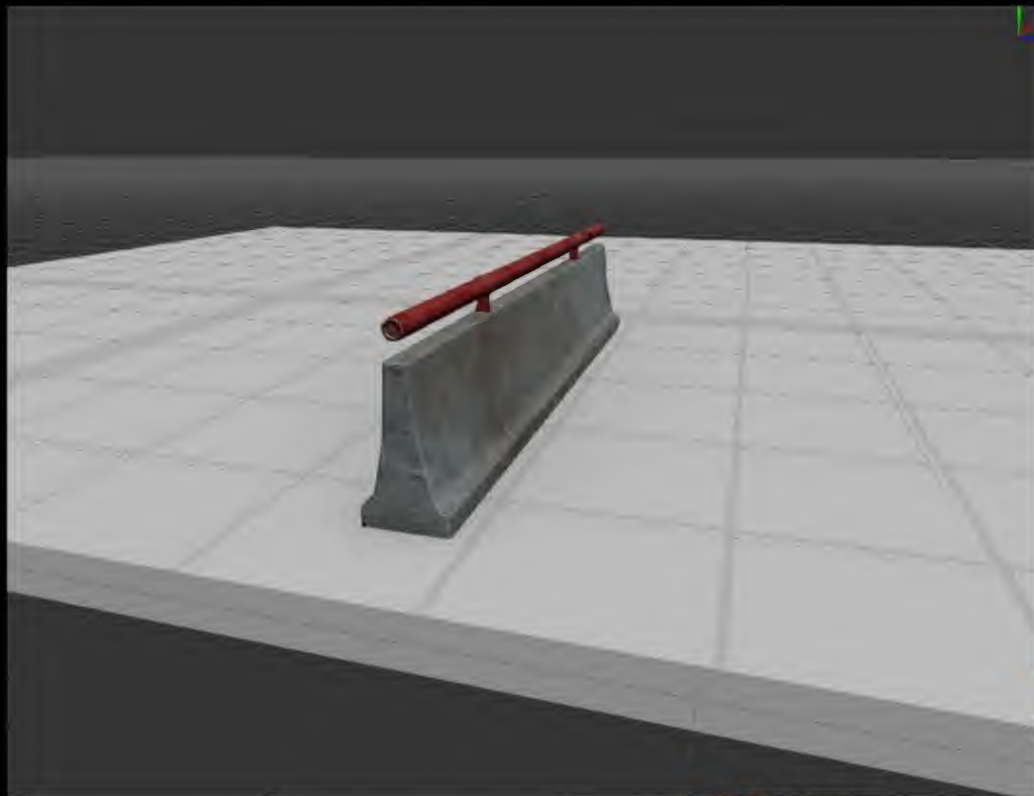


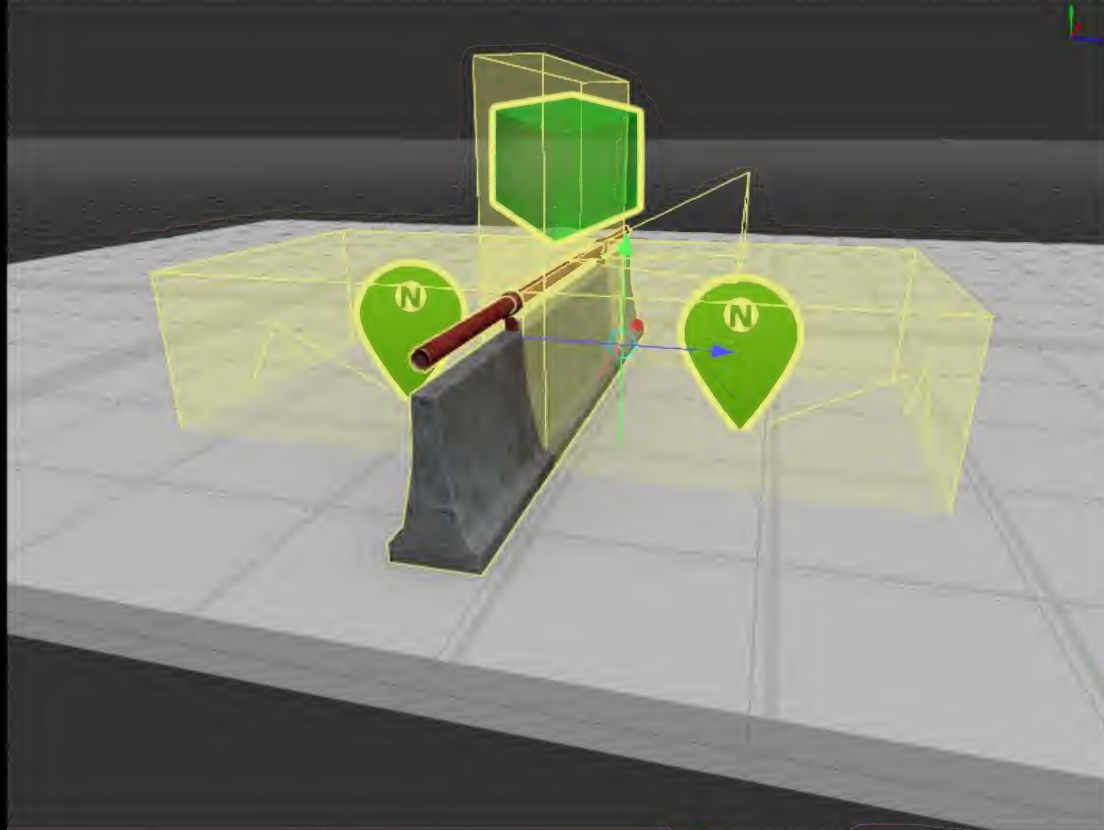


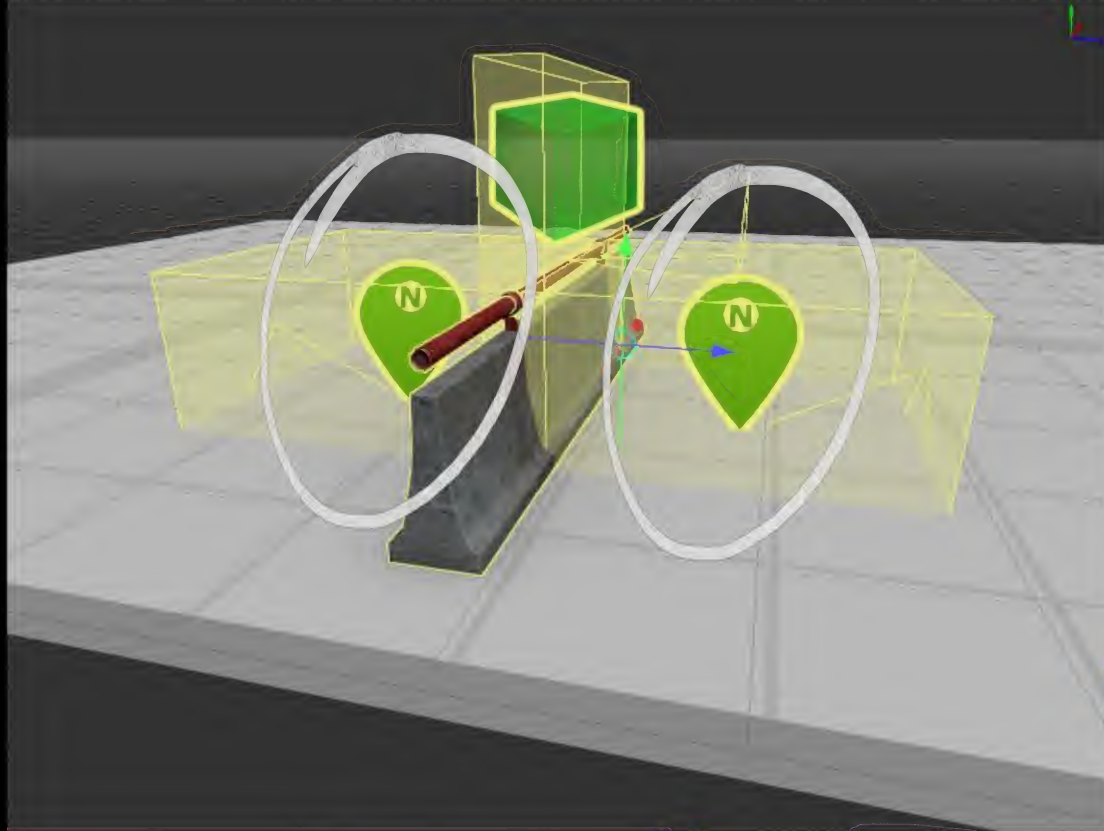


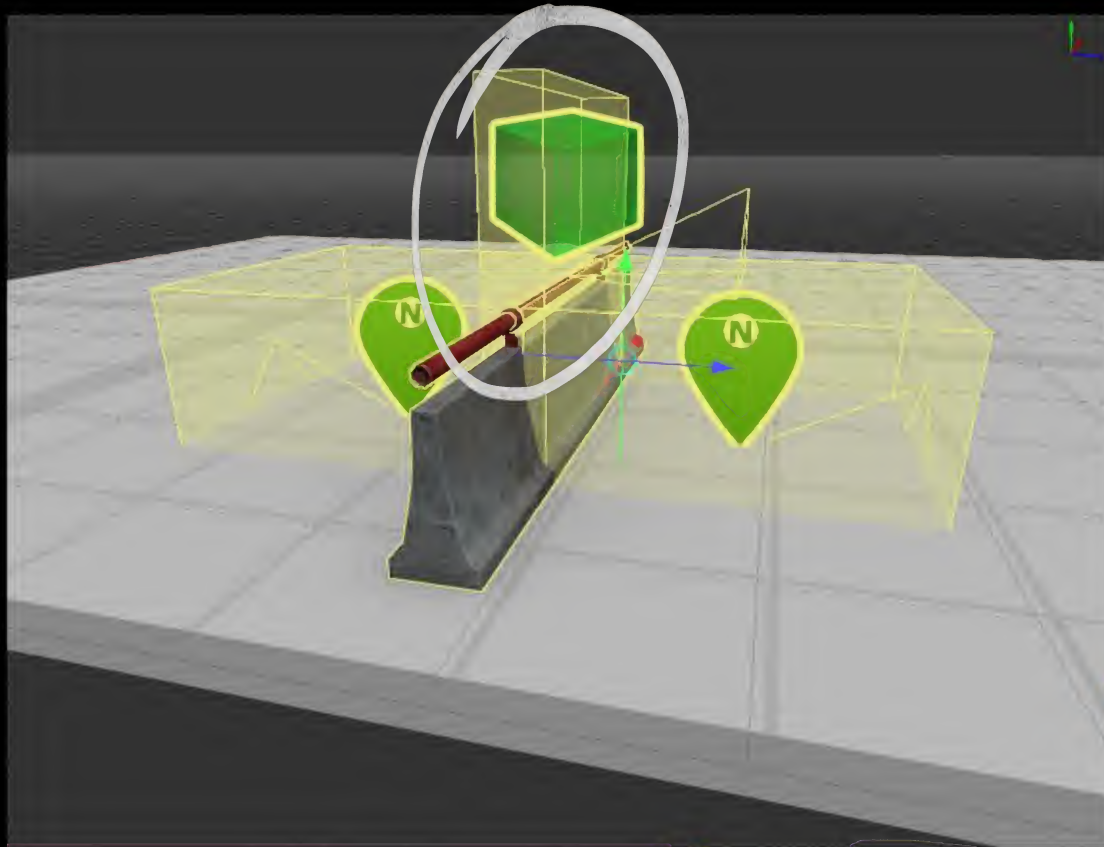


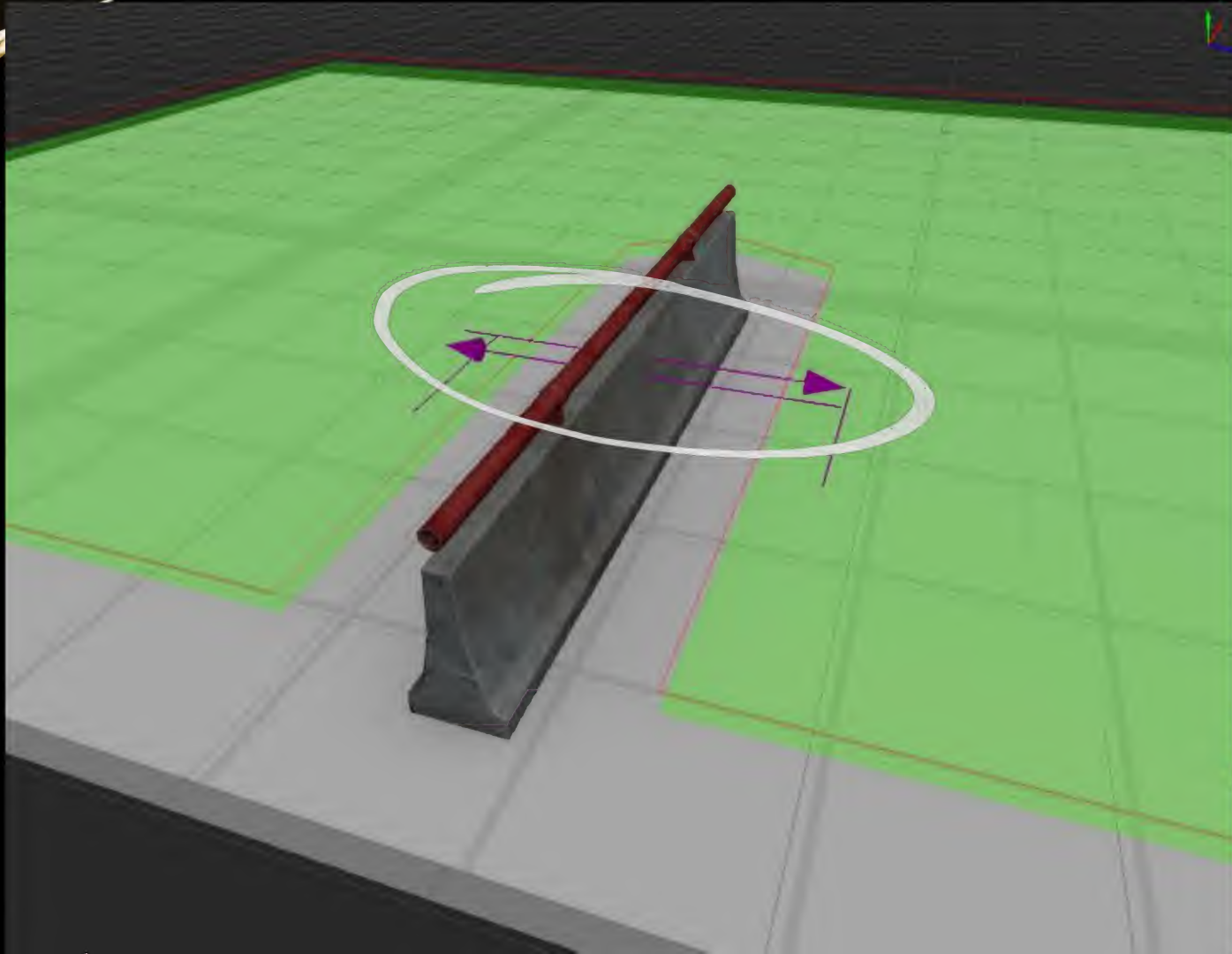
Navigation tools: Off-mesh connections







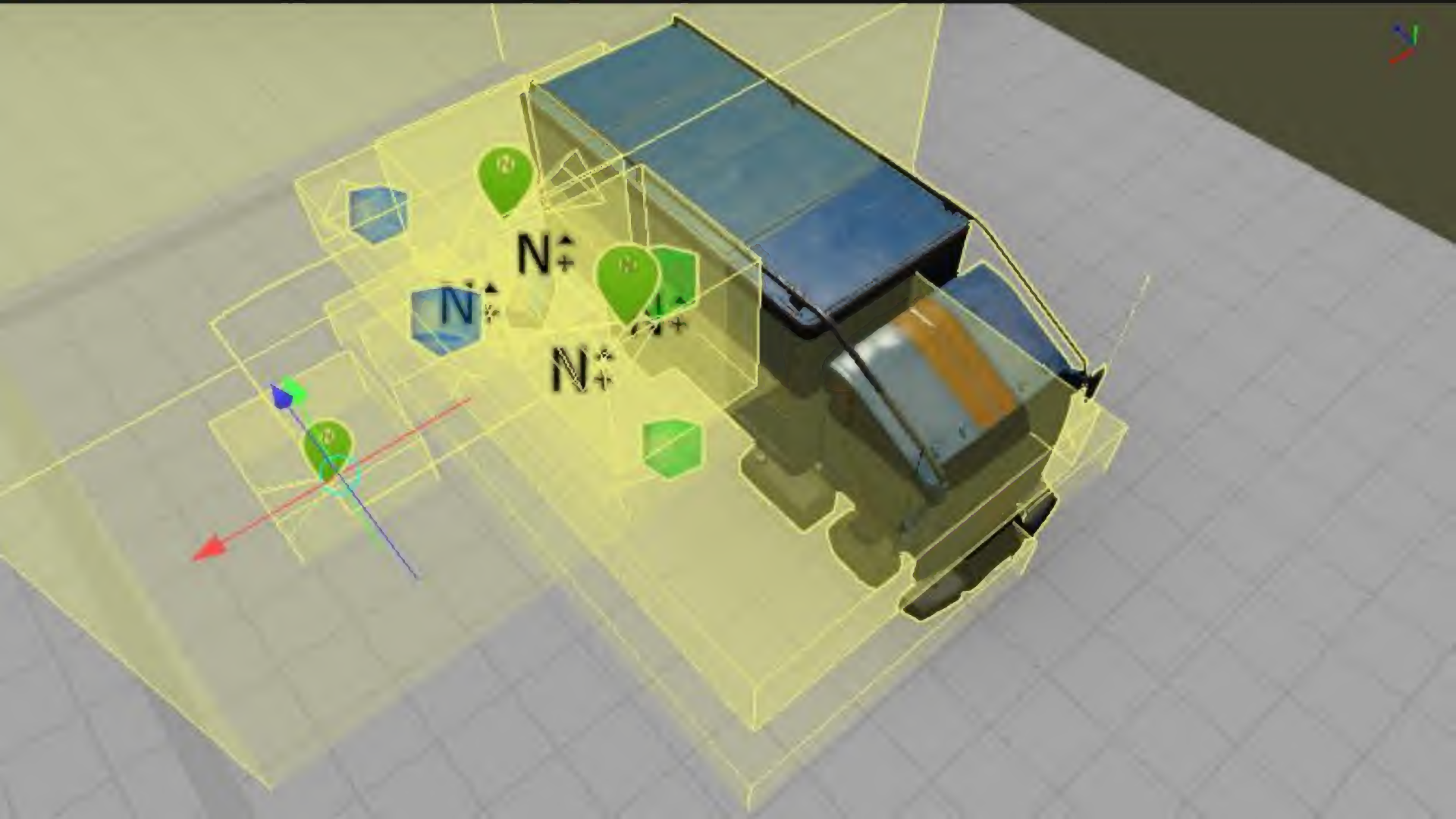


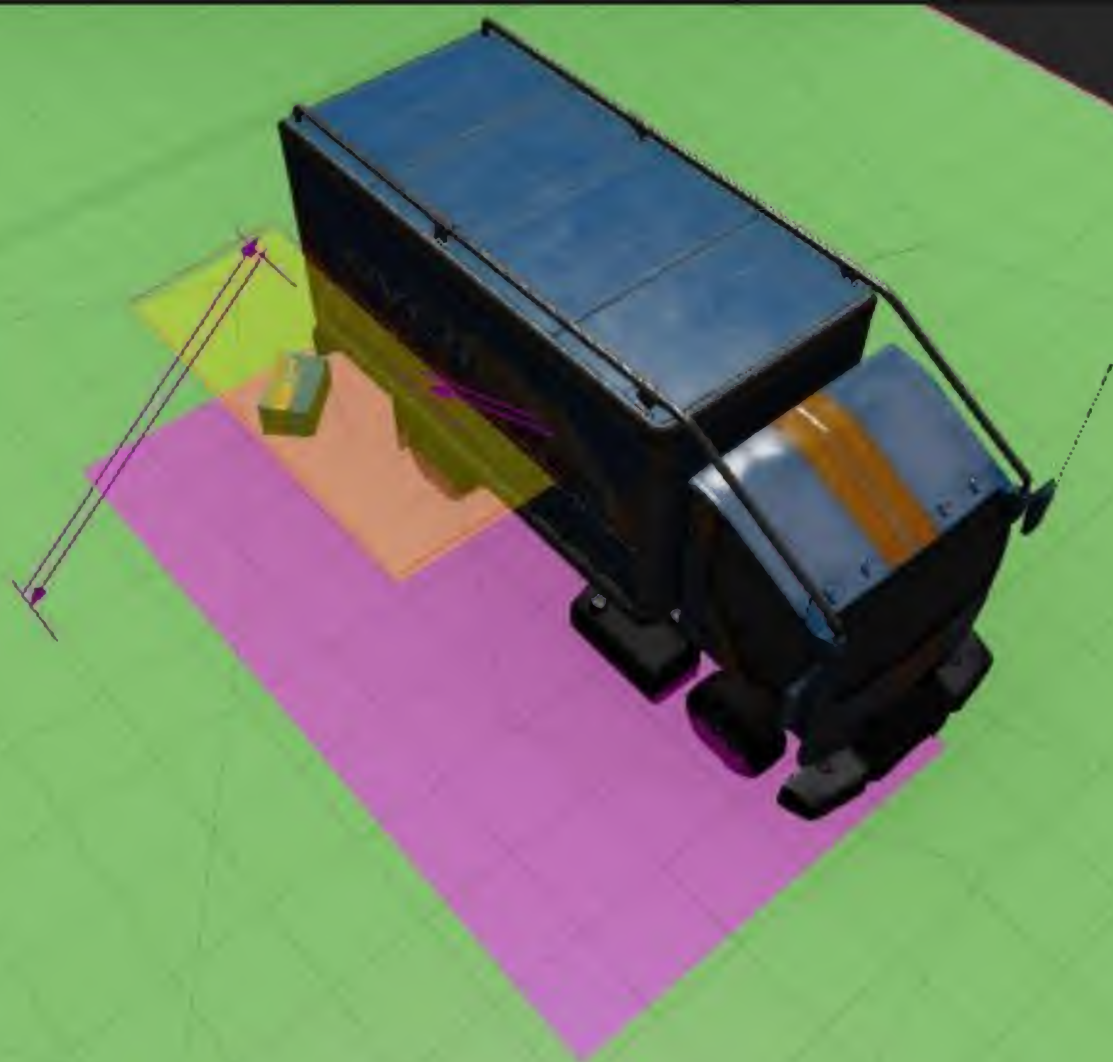


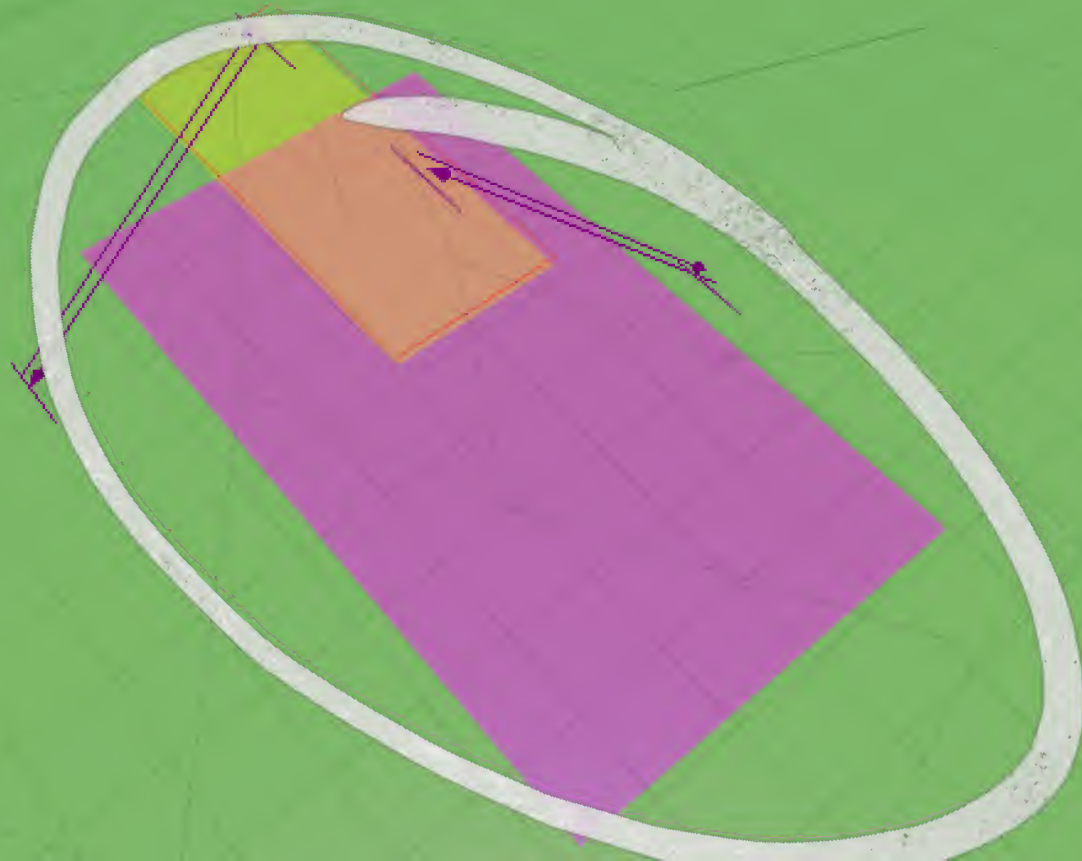


Putting it all together...

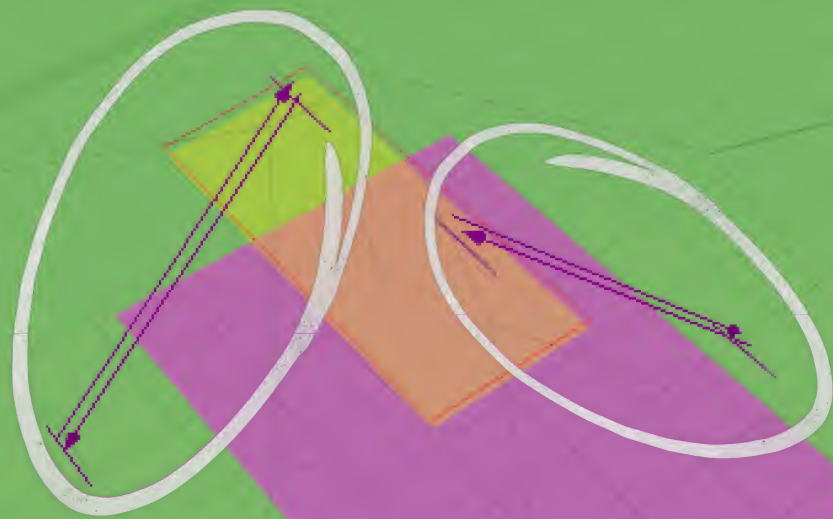


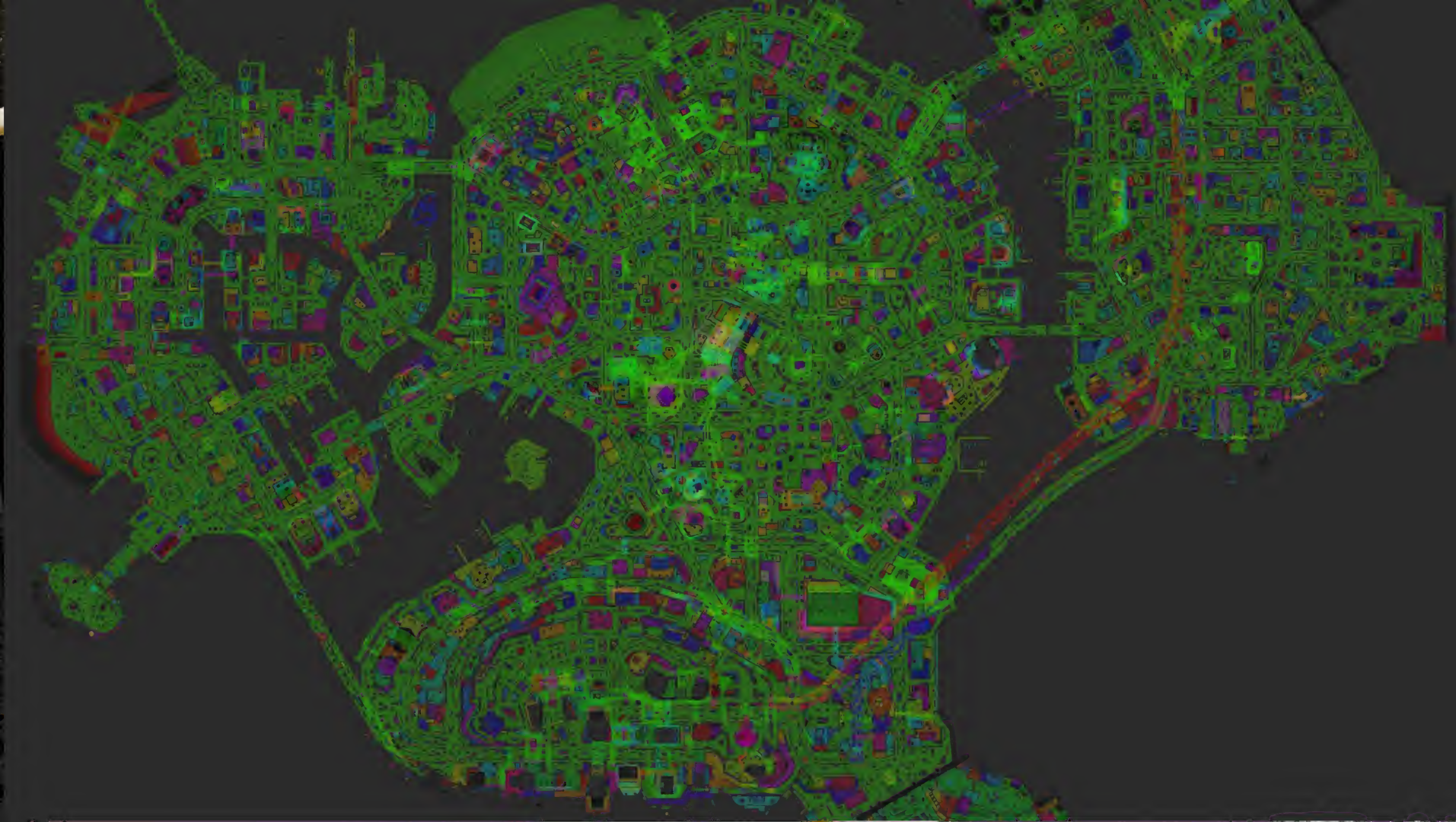














Questions, Comments, other Feedback...

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